Means of Daily Areas of Umbræ, Whole Spots, and Faculæ upon the Sun's Disk, as measured on Photographs taken at the Royal Observatory, Greenwich, for each Year, from 1873 *to* 1879.

The Mean Areas are expressed in millionths of the Sun's visible hemisphere.

Year.	Means of Daily Areas. Umbræ.	Whole Spots.	Faculæ.
1873	116	678	2882
1874	83	583	1095
1875	45	255	475
1876	25	132	226
1877	20	94	168
1878	5	25	84
1879	10	44	163

Many of the photographs taken during the early part of 1874 do not show the faculæ with sufficient distinctness to allow of their measurement; the mean area of faculæ given for that year is therefore too small.

The mean daily area of faculæ for the half-year beginning 1874, July 2, is 1257.

From these results it appears that the minimum both for Sun-spots and faculæ occurred about the end of 1878 and the beginning of 1879, and that there has since been a marked increase in the number of both.

Royal Observatory, Greenwich,
1880, *Jan.* 9.

Note referring to Observations and Estimations of the Brightness of Mars, which ought to be made in February and March 1880.

By A. Marth, Esq.

The apparent brightness of the planet *Mars* is now decreasing at such a rate, that in the course of February it will be reduced to that of some of the fixed stars of the first magnitude. The planet is unusually well placed for comparison with *α Tauri* and *α Orionis*, both stars of reddish hue and consequently better adapted for the purpose than others of different colour, and observers who may be favoured by clear evenings in the latter part of February and beginning of March ought therefore not to lose their opportunities for making such photometric measurements or naked-eye estimations as will serve to fix the time when *Mars* equals in brightness *α Orionis* and the time when it equals *α Tauri*. Seventy-nine years ago, on a certain evening in February 1801, Olbers estimated that *Mars* appeared just as

much brighter than *α Tauri* as it appeared fainter than *α Orionis*, and he made this estimate the foundation of his paper, "*Mars und Aldebaran*," in vol. 8 of Zach's *Monatliche Correspondenz*. The circumstances of the present apparition of the planet are not much different from those in 1801, and Olbers' old estimate accordingly suggests the time when *Mars* is likely to appear of the corresponding brightness. But since *α Orionis* is a variable or at least a suspected variable star, proper allowance must be made, and the comparisons must begin sufficiently early in February. The moonlight may be troublesome for some evenings, but this cannot be helped.

The ratio of the apparent brightness of *Mars* to that at mean opposition can only be given conditionally, since the real effect of the phase is not yet ascertained. If r is the distance of the planet from the Sun, Δ its distance from the Earth, and (in the notation of Lambert's photometric formula) v the phase-angle, or $180°-v$ the areocentric angle between Sun and Earth, the light-ratio will be

$= \frac{\text{const.}}{r^2 . \Delta^2} \cdot \sin^2 \tfrac{1}{2}v$, in case the amount of light depends simply on the proportion of the illuminated portion to the whole disk;

or

$= \frac{\text{const.}}{r^2 . \Delta^2} \cdot \frac{\sin v - v \cos v}{\pi}$, in case Lambert's photometric formula is valid.

In order to refer the brightness to that at mean opposition, the const. c is put $= a^2(a-1)^2$, where a is the major semi-axis of the planet's orbit, or $\log c = 9{\cdot}803945$.

The following table gives, for Greenwich Noon, the values of $\log \frac{c}{r^2 . \Delta^2}$, of the phase-angle v, and of the logarithms of the light-ratios in the two cases :—

1880.	$\log \frac{c}{r^2 . \Delta^2}$.	v.	$\log \left(\frac{c}{r^2 . \Delta^2} . \sin^2 \frac{1}{2}v\right)$.	$\log \left(\frac{c}{r^2 . \Delta^2} . \frac{\sin v - v \cos v}{\pi}\right)$.
		°		
Feb. 18	9·22960	141·84	9·1805	9·1414
20	·21421	141·85	·1651	·1261
22	·19905	141·87	·1500	·1110
24	·18414	141·91	·1352	·0963
26	·16945	141·96	·1207	·0818
28	·15500	142·02	·1064	·0676
Mar. 1	·14077	142·09	·0923	·0537
3	·12676	142·18	·0735	·0400
5	9·11296	142·27	9·0650	9·0267

Since *Mars* is near quadrature, and the angle v varies little, the uncertainty of the photometric formula will not sensibly affect the relative comparisons made during the interval.

The correction of the observations which takes into account the extinction of light in different zenith-distances may be diminished or avoided in case it is feasible to observe at the times when both objects are at the same zenith-distance. *Mars* and α *Orionis* allow this to be done till the beginning of March. If the angle τ is found from $\sin \tau = \nu \tan$. latitude, and expressed in time, the two bodies will be at the same altitude at the local sidereal time $\theta_o + \tau$. The values of $\log \nu$ and θ_o are given for 8^h G.M.T. in the following table, together with the times of the occurrence at Greenwich :—

Mars and α *Orionis*.

8^h Gr.	$\log \nu$.	θ_o.	At Greenwich.		
		h m	h m	h m	°
Feb. 18	9·7387	4 20·8	7 15 Sid.T.	= 9 24 M.T.	47·5 Z.D.
22	9·7810	4 20·9	7 34	9 26	49·2
26	9·8259	4 20·5	8 5	9 41	52·5
Mar. 1	9·8744	4 19·2	9 0	10 19	59·0
5	9·9264	4 16·7	...	...	...

Mars and α *Tauri* will not be observable in this way in our latitudes. But α *Tauri* and α *Orionis* will be at the same zenith-distance, if τ is found by $\sin \tau = [9{\cdot}6506]$ tan.latit., at $4^h\ 47^m{\cdot}6 + \tau$ local sidereal time, or for the latitude of London, at $7^h\ 4^m$ sidereal time, the zenith-distance being 46°·8.

Observation of the Outer Satellite of Mars, made at the Royal Observatory, Greenwich.

(*Communicated by the Astronomer Royal.*)

The following micrometer measures of *Deimos* were obtained with the great Equatoreal ($12\frac{3}{4}$ inches aperture) on the evening of 1879, November 12. It was also seen for a few moments on November 7, but no measures could be obtained on that occasion. The inner satellite, *Phobos*, was never seen.

1879, Nov. 12.

Measures of Distance.

Greenwich Mean Solar Time.			Greenwich Sidereal Time.			Distance in Arc.
h	m	s	h	m	s	″
11	24	21	2	51	12	66·47
11	49	27	3	16	22	62·77
12	23	3	3	50	4	60·46
12	44	45	4	11	49	58·14